CLAIMS

What is claimed is

1. A device for electroporating subsets of cultured cells or lipid vesicles to allow the entry of substances not capable of crossing a cell membrane, said device comprising;

a stimulator array to generate spatially variant voltages for electroporation;

a conducting microwire electrode material connected the stimulator array and to the cultured cells to cause electroporation; and

a fluid flow chamber and apparatus surrounding said stimulator array and said microwire electrode material.

2. The device according to claim 1 wherein said stimulator array is a computer controlled microelectronic chip for demultiplexing an input array into a two-dimensional array of electronic unit cells, wherein each unit cell acts as part of an electrode or clusters of electrodes to apply a time varying voltage to induce electroporation in adjacent cultured cells.

3. The device according to claim 1 wherein said microwire electrode material comprises microwire glass hybridized to said stimulator array with indium bumps.

4. A device according to claim 1 wherein said fluid flow chamber and apparatus comprises a liquid holding chamber with sidewalls, inflow and outflow ports, valves to prevent back flow, tubing to hold the solutions and a pump to drive the solutions into the chamber.

5. A device according to claim 1 wherein the unit cells and electrode material form the anode(s) and cathode(s) which together cause electroporation when a voltage is applied.

6. A device according to claim 1 wherein the unit cells and electrode material form the anode(s) or cathode(s) and the top of the chamber forms the opposing electrode, which together cause electroporation when a voltage is applied.

7. A device according to claim 1 wherein the unit cells and electrode material form the anode(s) or cathode(s) and a wire within the chamber forms the opposing electrode, which together cause electroporation when a voltage is applied.

8. A method for electroporating cultured cells or lipid vesicles to allow the entry of substances not capable of crossing a cell membrane, said method comprising the steps for:

plating cultured cells onto a microwire electrode material;

flowing in substances for cell treatment into a surrounding chamber;

applying an electroporation voltage from a stimulator array to a subset of said cultured cells of causing electroporation;

and washing out unused substances from said chamber.

9. The method according to claim 8 wherein said cultured cells or lipid vesicles are cultured in such a way as to plate or deposit them onto the surface of the conducting electrode material.

10. The method according to claim 8 wherein said cultured cells or lipid vesicles are in a monolayer.

11. The method according to claim 8 further comprising the step of injecting impermeant substances into the fluid flow chamber for entry of said substances into the cells or lipid vesicles.

12. The method according to claim 8 wherein the substances are genes, gene silencing RNAi, gene inhibition agents, drugs or chemicals suspended in or in solution with cell culture media.

13. The method according to claim 8 wherein the stimulator array applies transient voltage waveforms to the cells or lipid vesicles to electroporate said cells or lipid vesicles and allow the entry of the substances within the fluid flow chamber into said cells.

14. The method according to claim 8 wherein a liquid without the substances in solution or suspension is injected into the fluid flow chamber to washout residuals of the substances.

15. The method according to claim 14 wherein the washout contains molecules, which attract or bind the substances to improve washout.

16. The method according to claim 8 wherein the substances and liquid washout solutions, separated by regions of air, are loaded into the fluid flow apparatus tubing prior to the experiment at a remote location.

17. The method according to claim 8 wherein the substances are genes, gene silencing RNAi, gene inhibition agents and are loaded in to the chamber and electroporated into the desired cells to allow for gene transfection.

18. The method according to claim 17 wherein different genes, gene silencing RNAi, gene inhibition agents are serially injected into the fluid flow chamber and separately electroporated into cells or cell groups allowing the creation of an array of cells with different genes, gene silencing RNAi, gene inhibition agents, within a single chamber.

19. The method according to claim 8 further comprising the step of serially injecting different substances into the fluid flow chamber and separately electroporating into cells or cell groups to allow the creation of an array of differentiated cells, within a single chamber.

20. The method according to claim 8 further comprising loading the same substance at different concentrations into different cells by varying the duration, amplitude or frequency of the applied voltages while said cells are exposed to the same or different concentrations of a substance.